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EDUCATION

- Ph.D. in Chemical Engineering. August 2003, Technion, Haifa, Israel
- M.Sc. in Chemical Engineering. April 1999, Technion, Haifa, Israel
- B.S. in Chemical Engineering. February 1996, Mendeleyev University of Chemical Technology of Russia, Moscow, Russia

RESEARCH EXPERIENCE

November 2006 - present: Los Alamos National Laboratory, Los Alamos, NM
Post-Doctoral Research Associate, Center for Nonlinear Studies and Theoretical Biology and Biophysics Group, Theoretical Division. PIs: Dr. William S. Hlavacek and Dr. Byron Goldstein

- Development of rule-based stochastic algorithms for simulation of complex biochemical networks
- Construction of predictive models for ligand-receptor binding in immuno-receptor signaling (B-cell receptors, T-cell receptors, high-affinity receptors for IgE)

December 2004 - November 2006: North Carolina State University, Raleigh, NC
Post-Doctoral research associate, Chemical & Biomolecular Engineering Department, Engineering Analysis of Cell Signaling. PI: Prof. Jason M. Haugh

- Conducted computational analysis of reaction-diffusion mechanisms in enzymatic reactions at cell membranes, including development of continuum models and stochastic simulations (Brownian dynamics)
- Modeled PI-3 kinase signaling pathways leading to cell migration
- Developed computational models of wound healing and chemotaxis
- Designed and wrote simulation software in C/C++ integrated with visualization tools and GUI

December 2003 - November 2004: Princeton University, Princeton, NJ
Post-Doctoral research associate, Chemical Engineering Department & Lewis-Sigler Institute for Integrative Genomics, Computational Biology Group. PI: Prof. Stanislav Y. Shvartsman

- Performed a methodological study of particle diffusion and interactions at partially-absorbing surfaces with different arrays of absorbers and geometry (particle-based Brownian dynamics approach)
- Applied the developed computational models to simulate experimental autocrine/paracrine signaling systems

- Analyzed nonlinear dynamics of spatio-temporal pattern formation in developmental biology (Drozophila oogenesis)

March 1997 - August 2003: Technion, Haifa, Israel
Research assistant, Chemical Engineering Department. Advisor: Prof. Leonid M. Pismen

- Developed macro-scale models of spatio-temporal pattern formation in non-equilibrium media (phenomenological FitzHugh-Nagumo and time-dependent Ginzburg-Landau equations, Langmuir-Hinshelwood kinetic equations)
- Worked in close collaboration with experimental colleagues to explore instabilities, front propagation and waves in heterogeneous catalytic reactions conducted under low-pressure conditions
- Performed stability analysis of nonlinear and chaotic dynamical systems (global bifurcations, spatio-temporal instabilities in chemical kinetic systems)
- Developed stochastic simulation models (lattice Monte Carlo) and hybrid simulations (Monte Carlo combined with continuum kinetic equations, local boundary dynamics) to investigate the effect of surface phase transition and anisotropy on pattern formation in catalytic surface reactions
- Designed and wrote numerous simulation codes in C integrated with visualization tools and GUI

Visiting scientist

- September - October 2002: University of Hannover, Institute of Physical Chemistry and Electrochemistry, Hannover, Germany
- September - October 2000: Max Planck Institute for the Physics of Complex Systems, Pattern Formation Group, Dresden, Germany

TEACHING EXPERIENCE

1998-1999, 2000-2003: Technion, Chemical Engineering Department, Haifa, Israel
Teaching assistant for undergraduate and graduate courses:

- Statistical thermodynamics in chemical engineering (grad)
- Analytical methods in chemical engineering (grad)
- Transport phenomena: heat and mass transfer (grad)
- Adsorption and catalysis (undergrad/grad)
- Separation processes (undergrad/grad)
- Principles of chemical engineering (undergrad)

AWARDS

- Center for Nonlinear Studies postdoctoral fellowship, Los Alamos National Laboratory, 2006-2008
- Graduate fellowships, Technion, 1997-1999, 2000-2003
- Received financial support from German-Israeli Foundation, Max Planck Institute, and Minerva Center for Nonlinear Physics of Complex Systems for short-term research visits (up to 1.5 months) and conference participation, 2000-2002

PEER REVIEWED PUBLICATIONS

1. J. Yang, **M. I. Monine**, J. R. Faeder, W. S. Hlavacek. "Kinetic Monte Carlo method for rule-based modeling of biochemical networks". *Accepted, to appear in Phys. Rev. E*; arXiv:0712.3773v1 [q-bio.QM].
2. **M. I. Monine**, J. M. Haugh. "Cell population-based model of dermal wound invasion with heterogeneous intracellular signaling properties". *Accepted, to appear in Cell Adhesion and Migration.*
3. **M. I. Monine**, J. M. Haugh. "Signal transduction at point-blank range: simulation and analysis of spatially coupled crosstalk". *Accepted, to appear in Biophys. J.*
4. A. M. Berezhkovskii, **M. I. Monine**, C. B. Muratov, S. Y. Shvartsman. "Homogenization of boundary conditions for surfaces with regular arrays of traps". *J. Chem. Phys.*, **124**, 36103 (2006).
5. **M. I. Monine**, J. M. Haugh. "Reactions on cell membranes: comparison of continuum theory and Brownian dynamics simulations". *J. Chem. Phys.*, **123**, 74908 (2005).
6. **M. I. Monine**, A. M. Berezhkovskii, E. J. Joslin, H. S. Wiley, D. A. Lauffenburger, S. Y. Shvartsman. "Ligand accumulation in autocrine cell cultures". *Biophys. J.*, **88**, 2384 (2005).
7. A. M. Berezhkovskii, Yu. Makhnovskii, **M. I. Monine**, V. Zitserman, S. Y. Shvartsman. "Boundary homogenization for trapping by patchy surfaces". *J. Chem. Phys.*, **121**, 11390 (2004).
8. L. M. Pismen, **M. I. Monine**, G. Chernikov. "Patterns and localized structures in a hybrid non-equilibrium Ising model". *Physica D*, **199**, 82 (2004).
9. **M. I. Monine**, L. M. Pismen, R. Imbihl. "Realistic kinetic Monte Carlo simulation of the faceting of a Pt(110) surface under reaction conditions". *J. Chem. Phys.*, **121**, 11332 (2004).
10. **M. I. Monine**, L. M. Pismen. "Realistic kinetic Monte Carlo study of the surface phase reconstruction". *Phys. Rev. E*, **69**, 21606 (2004).
11. **M. I. Monine**, L. M. Pismen. "Reconstruction and roughening of a catalytic Pt(110) surface coupled to kinetic oscillations". *Phys. Rev. E*, **66**, 051601 (2002).
12. **M. I. Monine**, L. M. Pismen, M. Bär, M. Or-Guil. "Modeling triangular titration fronts in the O_2+H_2 reaction on a catalytic Rh(111) surface". *J. Chem. Phys.*, **117**, 4473 (2002).
13. **M. I. Monine**, A. Schaak, B. Y. Rubinstein, R. Imbihl, L. M. Pismen. "Dynamics of subsurface oxygen formation in catalytic water formation on a Rh(111) surface – experiment and simulation". *Cat. Tod.*, **70**, 321 (2001).
14. **M. I. Monine**, L. M. Pismen. "Roughening of catalytic surface due to reversible surface reconstruction coupled with oscillatory dynamics". *Cat. Tod.*, **70**, 311 (2001).
15. L. M. Pismen, R. Imbihl, B. Y. Rubinstein, **M. I. Monine**. "Two-tier symmetry-breaking model of patterns on a catalytic surface". *Phys. Rev. E*, **58**, 2065 (1998).

MANUSCRIPTS IN PREPARATION

- **M. I. Monine**, J. Yang, J. Colvin, R. G. Posner, W. S. Hlavacek, J. R. Faeder. "Modeling multivalent ligand-receptor interactions with constraints on configurations of cell-surface receptor aggregates: application to trivalent antigen interaction with IgE-FceRI complexes". *To be submitted to Biophys. J.*
- A. Nag, **M. I. Monine**, J. R. Faeder, B. Goldstein. "Oligomerization of LAT mediated by GRB2 and SOS1: Equilibrium Theory and Simulations". *To be submitted to Biophys. J*.
- J. Colvin, **M. I. Monine**, J. R. Faeder, W. S. Hlavacek, R. G. Posner. "DYNSTOC: a tool for simulating large-scale rule-based models". *To be submitted to Bioinformatics.*

REVIEWER FOR FOLLOWING JOURNALS

- Biophysical Journal
- Journal of Chemical Physics

PRESENTATIONS

Talks at conferences and seminars

- "Modeling aggregation of multivalent biomolecules in cells", *Stochastic Gene Transcription & Signaling Workshop*, Rice University, June 2007
- "Signal Transduction at Point-blank Range: Brownian Dynamics Simulations of Receptor-mediated Ras/PI 3kinase Crosstalk", *SIAM Conference on the Life Sciences*, August 2006.
- "Theoretical study of autocrine/paracrine signaling in cell culture assays", *Post-Doc Symposium*, Princeton University, May 2004.
- "Atomic-scale modeling of reaction-induced roughening in CO oxidation on Pt(110)", *Computational Physics seminar*, Technion, Israel, May 2003.
- "Simulation of roughening and faceting of a Pt(110) surface under reaction conditions", *7th Autumn Seminar on Structure Development in Chemistry and Biophysics*, Salzwedel, Germany, September 2002.
- "Reconstruction and roughening of catalytic surfaces coupled to kinetic oscillations", *Seminar of the Minerva Center for Nonlinear Physics of Complex Systems*, Israel, October 2001.
- "Monte Carlo simulation of the surface phase transition on a Pt(110) surface", *Seminar at Max Planck Institute for the Physics of Complex Systems*, Dresden, Germany, September 2000.
- "Propagating fronts and patterns on monocrystalline catalytic surfaces", *Chemical Engineering Seminar*, Technion, Israel, January 1999.

Poster Presentations

- "Simulation of Systems Marked by Combinatorial Complexity", M. Monine, J. Yang, A. Nag, B. Goldstein, J. Colvin, R. Posner, W. Hlavacek, and J. Faeder, *The Eight International Conference on Systems Biology*, October 2007.
- "Rule-based stochastic model of aggregate formation in systems of multivalent biomolecules", M.

Monine, J. Faeder, W. Hlavacek, R. Posner, A. Nag, and B. Goldstein, *First q-bio Conference on Cellular Information Processing*, August 2007.

- “Modeling aggregation of multivalent biomolecules in cellular systems”, M. Monine, J. Faeder, W. Hlavacek, R. Posner, A. Nag, and B. Goldstein, *27th Annual CNLS Conference on Complexity of Biological and Soft Matters*, May 2007.
- "Manipulation and Kinetic Analysis of Crosstalk between Pi 3Kinase/Akt and Ras/Erk Signal Transduction Pathways", C. Wang, M. Monine, and J. Haugh, *AIChE Annual Meeting*, November 2006.
- "Brownian dynamics simulations of receptormediated Ras/PI 3kinase crosstalk at the single molecule level", M. Monine and J. Haugh, *MABEC*, June 2006.
- “Signal transduction reactions at cell membranes: comparison of continuum theory and Brownian dynamics simulations”, M. Monine and J. Haugh, *AIChE Annual Meeting*, November 2005.
- “Modeling and analysis of spatially biased signaling and cell migration”, I. Schneider, M. Monine, and J. Haugh, *Cell Migration Consortium Meeting*, May 2005.
- “Multiscale model of patterns on a catalytic surface”, M. Monine, L. M. Pismen, and B. Rubinstein, *The Annual meeting of the Israel Institute of Chemical Engineers*, Technion, Israel, April 1998.

Conference Abstracts

- "Integration of Signal Transduction in Wound Invasion", M. Monine and J. Haugh, *AIChE Annual Meeting*, November 2006.
- “Signal Transduction at Point-Blank Range: a Brownian Dynamics Study”, M. Monine and J. Haugh, *AIChE Annual Meeting*, October 2005.
- “The dynamics of autocrine/paracrine ligand concentrations in cell culture assays”, M. Monine, A. Berezhkovskii, and S. Shvartsman, *AIChE Annual Meeting*, November 2004.
- “Mechanistic model of growth factor/fibroblast population dynamics during wound healing”, J. Haugh, M. Monine, and S. Shvartsman, *AIChE Annual Meeting*, November 2004.
- “Pattern formation, reconstruction, and roughening on a catalytic surface”, M. Monine and L. Pismen, *10th International Symposium on Continuum Models and Discrete Systems (CMDS10)*, Shoresh, Israel, July 2003.

REFERENCES

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